Construction of 100 MeV Electron Linac

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An electron linear accelerator has been constructed as an injector of the storage ring. The output beam energy of the linac is 100 MeV and the designed beam current is 100 mA at the pulse width of 1 μsec. The construction of the linac has been finished and we succeeded to accelerate the electron beam of 140 mA in October, 1995. The precise measurements of the beam parameters are now going.

Keywords: Linear Accelerator/ Synchrotron Radiation/ disc-loaded structure/ klystron

A compact electron storage ring (Kaken Storage Ring, KSR) and the linear accelerator are now under construction at the Institute for Chemical Research (1),(2). The layout of the accelerators is shown in Fig. 1. The maximum beam energy of the KSR is 300 MeV. It will be used as the synchrotron radiation source from the dipole magnet and the insertion device. The critical wave length is 17 nm.

The electron linac is composed of an electron gun, a buncher and three accelerating structures. The output beam energy is 100 MeV. It will be used for the beam injection to the KSR and the experiments using the 100 MeV electron beam.

The electron gun is a Pierce type gridded gun. The maximum extraction voltage is -100 kV. The phase spread of the beam is reduced by the pre-buncher and the buncher. The designed phase spread of is within 3 degree at the beam current of 100 mA when the input power is 12 MW. The main accelerating structure is a disc-loaded one and a traveling wave type. The electric field is 45 MV per one accelerating structure without beam loading at the input power of 20 MW.

Table 1. Main parameters of the electron beam.

Energy	100 MeV
Beam Current	100 mA
Pulse Width	1 μsec
Maximum Repetition	20 Hz

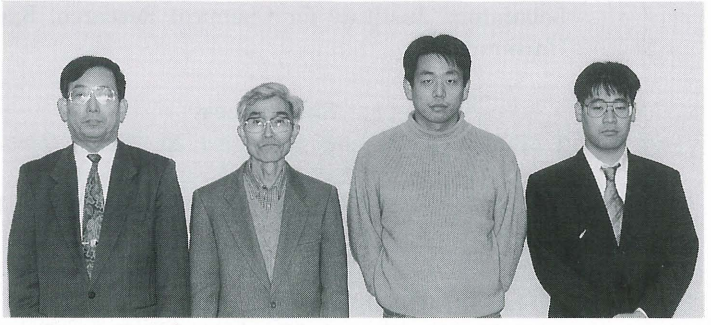
The RF frequency is 2857 MHz and the main RF amplifier is a klystron (ITT-8568). The maximum output power is 21 MW and the RF pulse width is 2 μsec. The stabilized power supply for the klystron modulator is used to keep the klystron power and the output beam energy. The klystron voltage stability is less than 3×10^{-3}.

Figure 2 shows the input RF power of the third accelerating structure and the accelerated beam pulse. The RF power is 20 MW and the beam current is 140 mA.

NUCLEAR SCIENCE RESEARCH FACILITY —Particle and Photon Beams—

Scope of Research

Particle and photon beams generated with accelerators and their instrumentations both for fundamental research and practical applications are studied. The following subjects are being studied: beam dynamics related to the space charge force in the accelerators: beam handling during the injection and extraction processes of the accelerator ring: radiation mechanism of photon by electrons in the magnetic field: interactions in the few-nucleon systems: R&D to realize a compact proton synchrotron dedicated for cancer therapy: and irradiation of materials with particle and photon beams.



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References

1. T.Shirai, *Bull. Inst. Chem. Res., Kyoto Univ.*, **73**, No.1, 1995, p78.
2. A. Noda, *Bull. Inst. Chem. Res., Kyoto Univ.*, **73**, No.1, 1995, p27.

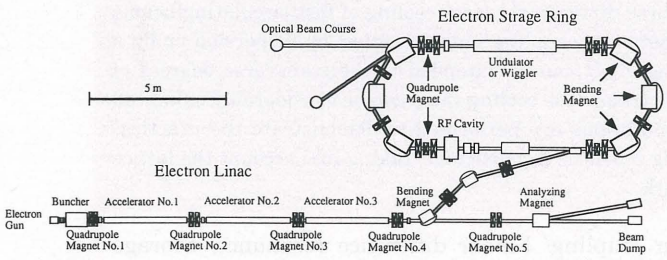

Figure 1. Layout of the linac and the KSR.

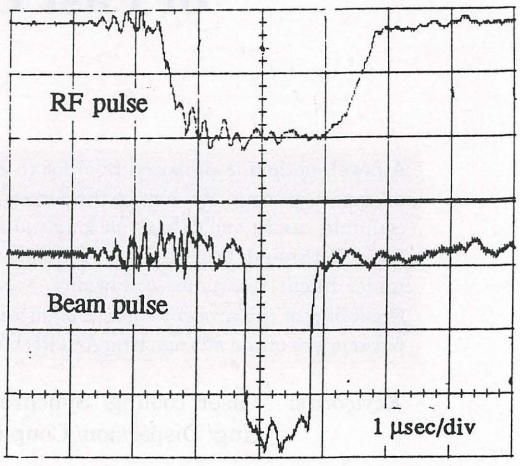

Figure 2. Input RF pulse of the third accelerating structure and the accelerated beam pulse.

Quasifree-Scatterings and Quasifree-Reactions on Light Nuclei

Tadahiko Yoshimura and Shigeru Kakigi

The alpha cluster in a nucleus is expected to be softened compared with the alpha particle. To investigate experimentally the softening of the alpha cluster, it is desirable to measure the ratio of the cross section for the quasifree-scattering to that for the quasifree-reaction and to compare it with the corresponding ratio for the free processes.

Keywords: alpha cluster /Quasifree process

Alpha cluster structures have been studied both experimentally and theoretically and alpha clusters have been recognized to exist in many nuclei. This fact is due to the tight binding of the alpha particle with the binding energy of about 7 MeV/nucleon, large compared with neighboring nuclei. However, the alpha cluster in a nucleus is expected to be softened slightly through interactions with other nucleons surrounding the alpha cluster. An interesting problem arises: how much is the degree of the softening of the cluster.

The cluster structures of light nuclei have been investigated experimentally through quasifree processes at intermediate energies. In these processes, the projectile interacts directly with the alpha cluster in the target nucleus and the remaining part of it is playing as a spectator. In the quasifree-scattering (QFS), the projectile is quasi-elastically scattered from the alpha cluster. Another process is possible, that is the quasifree-reaction (QFR) [1], in which the collision of the projectile and the alpha cluster leads to two-body rearrangement reactions. Experimentally it is desirable to measure the ratio of the cross section for the QFS to that for the QFR in order to cancel distortion effects. If the softening of the alpha cluster is assumed, the ratio for the quasifree processes is expected to decrease compared with the corresponding ratio for the free processes.

The experiments were performed with an 120 MeV alpha-particle beam and a 296 MeV proton beam from the AVF cyclotron and the ring cyclotron, respectively, at RCNP of Osaka University. The target nuclei were ^{6}Li, ^{7}Li, ^{9}Be and ^{12}C. Our preliminary results are suggesting the softening of the alpha cluster in ^{6}Li. Further analyses are now in progress. The experiments were performed at RCNP in E46 and R04 collaborations.

References

1. Okihana A, Yoshimura T, Kakigi S, Ushiro K and Sekioka T, *RCNP Annual Report* 1994, 29.